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**OPERATIONS AND MAINTENANCE MANUAL
FOR EXPANDED BIOVENTING SYSTEM
AT
FORMER UNDERGROUND STORAGE TANK FARM
BOLLING AFB, WASHINGTON D.C.**

Prepared For:

**Air Force Center For Environmental Excellence
Brooks AFB, Texas
USAF Contract F41624-92-D-8036 Delivery Order 17**

and

**110th Civil Engineering Squadron
Bolling AFB, Washington**

Parsons Engineering Science, Inc. December 1995

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**OPERATIONS AND MAINTENANCE MANUAL
FOR EXPANDED BIOVENTING SYSTEM
AT
FORMER UNDERGROUND STORAGE TANK FARM
BOLLING AFB, WASHINGTON D.C.**

Prepared For:

**AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BROOKS AFB, TEXAS
USAF CONTRACT F41624-92-D-8036 DELIVERY ORDER 17
AND
110th CIVIL ENGINEERING SQUADRON
BOLLING AFB, WASHINGTON D.C.**

Prepared By:

**PARSONS ENGINEERING SCIENCE, INC.
290 ELWOOD DAVIS ROAD, SUITE 312
LIVERPOOL, NEW YORK 13088**

DECEMBER 1995

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SECTION 1

INTRODUCTION

This document has been prepared by Parsons Engineering-Science, Inc. (Parsons ES) to support the bioventing follow on contract awarded by the Air Force Center for Environmental Excellence. The contract involves the conducting of bioventing pilot tests at Air Force bases across the United States.

At most sites, bioventing systems will be installed upon completion of the bioventing pilot tests for the purpose of extended pilot testing. These systems will operate for a one year period to provide further information as to the feasibility of the technology at each site, and to provide remedial action in order to close out the site.

This Operations and Maintenance Manual has been created specifically for Bolling AFB's combination injection and extraction bioventing system. Basic maintenance of this system is the responsibility of the base. The manual is to be used by base personnel to guide and assist them in operating and maintaining the blower system. Section 2 of this document describes the blower. Section 3 details the maintenance requirements and provides maintenance schedules. Section 4 describes the system monitoring that is required to forecast system maintenance needs and provide data for the extended pilot test. Blower performance curves and relevant service information are provided in Appendix A, and data collection sheets are provided in Appendix B.

SECTION 2

BIOVENTING SYSTEM OPERATION

2.1 PRINCIPLE OF OPERATION

Bioventing is the forced injection of fresh air, or withdrawal of soil gas, to enhance the supply of oxygen for in-situ bioremediation. Either a pressure (air injection) or vacuum (vapor extraction) blower unit is used to inject or withdraw air into or from the soil, thereby supplying fresh air with 20.8 percent oxygen to contaminated soils. Once oxygen is provided to the subsurface, existing bacteria will proceed with the breakdown of fuel residuals.

At Bolling AFB's Former Underground Storage Tank Farm (FTF), two blowers have been installed, a 5 horsepower combination injection/extraction, rotary vane, compressor-type blower, and a 1.5 horsepower rotary vane, air injection, compressor-type blower.

2.2 SYSTEM DESCRIPTION

2.2.1 Blower System

Two blowers have been installed at the FTF site in order to inject and extract sufficient air into and from the zone of contamination. A GAST® Model 2067 oilless rotary vane, compressor-type blower provides air to vent well VW-1 (See Figure in Appendix A). This blower is rated at 15 scfm at 3 pounds per square inch (psi), however, the actual performance of the blower will vary with changing site conditions. A GAST® model 4080 rotary vane, dual function compressor-type blower is used to extract air from vent well VW-3 and inject air into vent well VW-2 and VW-4. This blower is rated at 40 scfm at 5 psi of pressure and 5 psi of vacuum. The system installed at the FTF site also includes a Dayton® Stationary ASME Code Air Tank with a 30 gallon capacity and a maximum allowable pressure of 200 psi. This tank is used to remove entrained moisture from the extracted air stream. A schematic of the blower system installed at the FTF site, corresponding blower performance curves, and relevant service information are provide in Appendix A.

2.2.2 Monitoring Gauges

The bioventing system is equipped with pressure, vacuum, and temperature gauges as shown in Appendix A. A temperature gauge (T₂) and a pressure gauge (P₁) are located at the outlet or exhaust side of the 2067 compressor. The pressure gauge is used to measure outlet pressure on the blower and should read less than 5 psi while the blower is in operation. The temperature gauge is used to measure blower temperature and should read less than 200°F while the blower is operating.

A pressure/vacuum gauge (P₃) is located on the intake side of the 4080 compressor. This gauge is used to measure the vacuum on vent well VW-3 and should read less than 5 psi while the blower is in operation. A temperature gauge is located on the outlet side of the 4080 compressor to measure exhaust temperature. This gauge

should read less than 200°F while the blower is in operation. Two pressure gauges are also located on the outlet side of the blower. Pressure gauge P₂ measures the pressure exerted on vent well VW-2 and pressure gauge P₄ measures the pressure exerted on vent well VW-4. Both of these gauges should read less than 5 psi.

2.2.3 Pressure Relief Valve

Automatic pressure relief valves are located on the outlet side of both the 2067 and 4080 compressors. These valves assure protection to the blower in the event of excessive outlet pressures. These valves have been manually set at 5 psi. In the event that outlet pressure exceeds 5 psi, the valve will open and relieve the excessive pressure.

In addition to the automatic relief valves, manual relief valves (or bypass control valves) are located on the outlet side of each blower (CV₁ or CV₅). These valves allow manual control of the outlet pressure. A dilution air valve (or bypass control valve) CV₃ is also located on the inlet side of the 4080 compressor. This valve allows manual control of the vacuum asserted on the air extraction vent well (VW-3) and allows dilution air to be mixed with the extracted air stream. See the system schematic (Appendix A) for the location of the relief valves installed on the blower system.

2.2.4 Control Valves

Control valves have been installed on the system to control the flow of air into or from each vent well. Control valves CV₁ and CV₃ also serve as pressure or vacuum relief valves as described above. As shown in the schematic in Appendix A, CV₁, CV₂ and CV₄ control the air injected into vent wells VW-1, VW-2, and VW-4, and CV₃ controls the amount of air extracted from vent well VW-3. These valves can be adjusted in order to maintain equal flows into each vent well and out of the extraction vent well.

SECTION 3

SYSTEM MAINTENANCE

3.1 BLOWER/MOTOR MAINTENANCE

Although the motor is relatively maintenance free, the system requires periodic maintenance for proper operation and long life. Recommended maintenance procedures and schedules are described in detail in this section. The blower and motor should not require any periodic maintenance during the 1-year extended testing period.

Filter inspection must be performed with the system turned off. To re-start the motor, open the manual bypass valve (CV₁ or CV₅) to protect the motor from excessive strain, start motor, and slowly close bypass valve to its original setting. If the handle has been removed from the manual air dilution valve, do not open the valve or otherwise change the setting (it has been pre-set for a specific flow rate) before re-starting the blower.

3.1.1 Lubrication

The rotary vane compressor-type blowers require no lubrication.

3.2 AIR FILTER MAINTENANCE

To avoid damage caused by passing solids through the Model 2067 compressor, an air filter has been installed in-line before the blower. The filter should be checked monthly to determine the best schedule for filter replacement. The polyurethane prefilters can be washed with lukewarm water and a mild detergent. When replacing the filter, be careful that the rubber seals remain in place.

The Model 4080 compressor has an air filter located on the intake side of the blower. This filter is accessible by removing the filter box cover on the intake side of the blower. This internal intake filter requires periodic inspection and replacement. Replacement schedules for these filters are described below.

Additional filters can be obtained through Parsons ES in Syracuse, New York. The Parsons ES contacts are Mr. John Mastracchio and Mr. David Brown and they can be reached at (315) 451-9560.

3.3 MOISTURE SEPARATOR (KNOCK OUT POT) MAINTENANCE

The moisture separator's function is to remove entrained moisture from the extracted air stream. As air flows through the tank, any moisture that is entrained in the air stream falls to the bottom of the tank. The moisture separator tank has a maximum capacity of 30 gallons. The water collected in this tank should be drained on a weekly basis to prevent reaching full capacity of the tank. The tank can be drained

by shutting off the power to the blower at the electrical box (the 4080 pump breaker is labeled "pump 2") and opening the drain valve located outside of the blower shed. The valve should remain open until all of the water has been removed from the tank. The drain valve should then be closed and the pump should be restarted.

3.4 MAINTENANCE SCHEDULE

The following maintenance schedule is recommended for this system. During the initial months of operation more frequent monitoring is recommended to ensure that any start up problems are quickly corrected. A daily drive-by inspection is recommended during the initial two weeks of operation to ensure that the blower system is still operating with no unusual sounds. Data collection sheets have been provided to assist your data collection and are included in Appendix B.

<u>Maintenance Item</u>	<u>Maintenance Frequency</u>
Filter	Check once per month. Wash or replace as necessary.
Moisture Separator	Check once per week. Open drain valve to release water.

3.5 MAJOR REPAIRS

Blower systems are very reliable when properly maintained. Occasionally, a motor or blower will develop serious problems. If a blower system fails to start, and a base electrician verifies that power is available at the starter, the Parsons ES site manager, John Mastracchio, should be called at (315) 451-9560. Parsons ES is responsible for major repairs during the first year of operation.

SECTION 4

SYSTEM MONITORING

4.1 BLOWER PERFORMANCE MONITORING

To monitor the blower performance, pressure and temperature will be measured. These data should be recorded weekly on a data collection sheet provided in Appendix B. All measurements should be taken at the same time while the system is running. Since the System is loud, ear protection should be worn at all times.

4.1.1 Vacuum/Pressure

Record the pressure and vacuum readings directly from the respected gauges (in pounds per square inch or inches of mercury). Record the measurement on the data collection sheet provided in Appendix B.

4.1.2 Flow Rates

The flow rate through the vent well and soils can be calculated when the inlet vacuum and outlet pressure of the blower is known. This discharge pressure can be compared to the performance curves for the blower in Appendix A to determine the approximate flow rate.

4.1.3 Temperature

Record the temperature readings directly from the gauge in degrees Fahrenheit. Record the measurements on the data collection sheet provided in Appendix B. The temperature change can be converted to degrees Celsius ($^{\circ}\text{C}$) using the formula $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9$.

4.3 MONITORING SCHEDULE

The following monitoring schedule is recommended for this system. During the initial months of operation more frequent monitoring is recommended to ensure that any start up problems are quickly corrected. Data collection sheets have been provided to assist your data collection and are included in Appendix B.

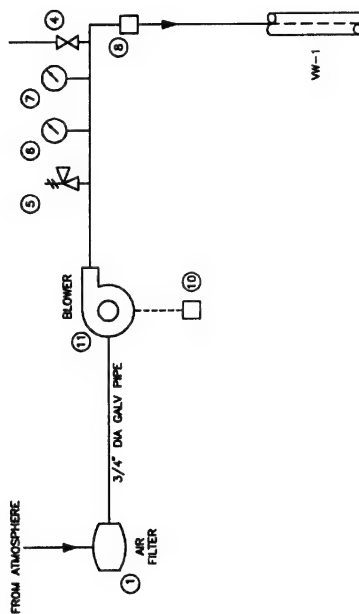
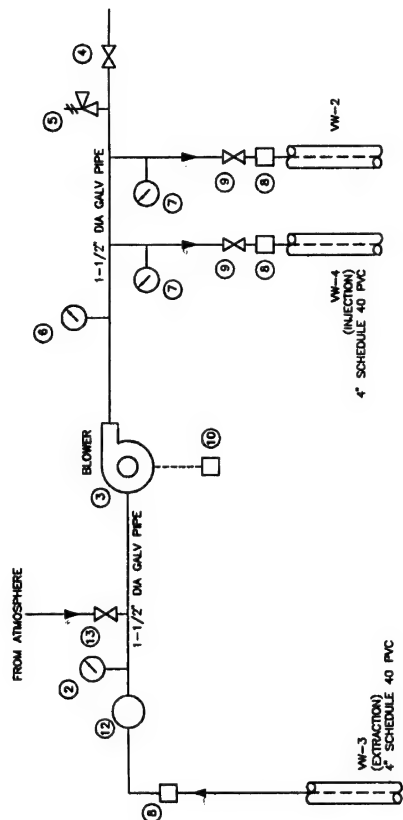
<u>Monitoring Item</u>	<u>Monitoring Frequency</u>
Pressure/Vacuum	Daily during first week, then once per week.
Temperature	Daily during first week, then once per week.

APPENDIX A

C-0-0.4		EXPANDED BIOVENTING SYSTEM FORMER UST TANK FARM ROLLING AFTN, WASHINGTON, D.C.	THOMAS P. A. ID
C-0-0.4		AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)	SVAN ANTONIO, TEXAS
C-0-0.4		PROKOS AIR FORCE BAE	(AFCEE)
C-0-0.4		PARSONS ENGINEERING INC.	WATKINS, N.Y.
C-0-0.4		CONSTRUCTION	(315) 451-0550
C-0-0.4		NOT FOR BIDDING OR CONSTRUCTION	
C-0-0.4		Issue Certification	
C-0-0.4		Job No. 228278	
C-0-0.4		Drawn: JLT	
C-0-0.4		Checked: JLT	
C-0-0.4		Approved: JLT	
C-0-0.4		Date: 10/1/88	
C-0-0.4		Rev: 1	
C-0-0.4		Date: 10/1/88	
C-0-0.4		Description: 10/1/88	

LEGEND

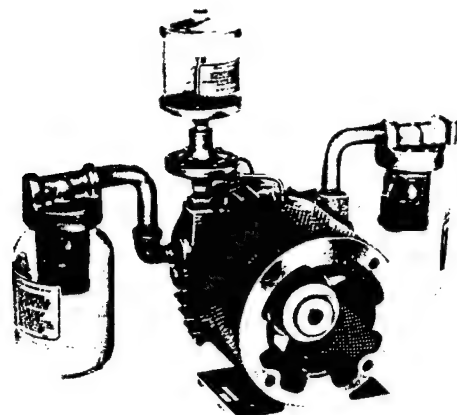
- 1 INLET AIR FILTER - SOLBERG F-30P-250, REPLACEMENT ELEMENT 30P
- 2 VACUUM GAUGE
- 3 BLOWER - CAST[®], 5 HP 4080-P121, 40 CFM AT 5 PSI PRESSURE
- 4 MANUAL PRESSURE RELIEF (BLEED) VALVE - 2" BALL
- 5 AUTOMATIC PRESSURE RELIEF VALVE - CAST, SET TO RELEASE AT 10 PSI PRESSURE (Part No. 24605 FROM GRAMMERC)
- 6 TEMPERATURE GAUGE - ASHROFT, 0-250°F, 1/2" NPT, CSM
- 7 PRESSURE GAUGE - CAST[®], 1/4" NPS, 0-300 PS (Part No. A46448)
- 8 FLOW MEASURING PORT (1/8" NPT) FITTED WITH PLUG
- 9 FLOW CONTROL VALVE - 2" BALL
- 10 STARTER
- 11 BLOWER CAST[®] MODEL 2087, 15CFM AT 3 PSI PRESSURE
- 12 DAYTON[®] STATIONARY ASME CODE AIR TANK, 30 GAL. MAXIMUM PRESSURE 200 PSI
- 13 MAKE-UP AIR VALVE - 2" BALL



1 2-0.4 BLOWER PIPING AND INSTRUMENTATION DIAGRAM

SCALE: NTS

Lubricated 1067, 2067, 2567 Series



MODEL 1067 SERIES
27" HG MAX. VAC., 8.50 CFM OPEN FLOW

MODEL 2067 SERIES
28" HG MAX. VAC., 17.00 CFM OPEN FLOW

MODEL 2567 SERIES
28" HG MAX. VAC., 21.00 CFM OPEN FLOW

PRODUCT FEATURES

- Lubricated operation
- Close coupled/easy motor mounting
- Rugged construction/low maintenance
- Essentially pulse free service

INCLUDES

- Filter AA800C (1067), AA900D (2067/2567)
- Muffler AA800D (1067), AA900E (2067/2567)
- Oil reservoir AA960
- Fan guards AC102C, AH194A
- Fan/coupling assembly AH198
- Vac lubricator V40C

RECOMMENDED ACCESSORIES

- Vacuum relief valve AA840A (1067), AA308 (2067/2567) – US/Imperial
- Vacuum relief valve AA840C (1067), AA308B (2067/2567) – Metric
- Vacuum gauge AA640 – US/Imperial
- Vacuum gauge AA640C – Metric
- Oil AD220
- Repair kit K355 (1067)
- Repair kit K349 (2067/2567)

EUROPEAN MODEL

Product Dimensions Metric (mm)

Model	A	B	C	D	E	F	G	H	I	J	K	L	M
1067	466	213	384	267	144	102	11	125	165	241	142	19	80
2067	475	229	387	305	144	102	11	125	165	284	164	19	80
2567	475	229	387	305	144	102	11	125	165	284	164	19	80

Dimensions for reference only.

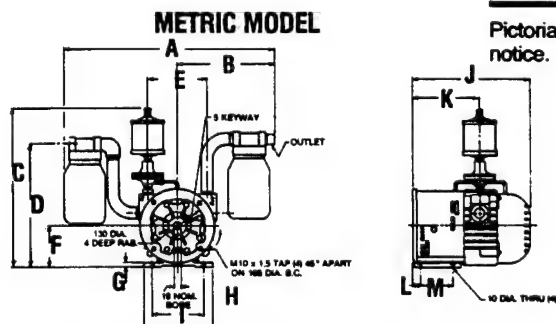
U.S. MODEL

Product Dimensions Metric (mm) U.S. Imperial (inches)

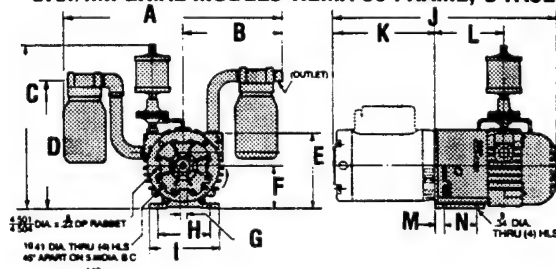
Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1067	466	213	384	267	180	102	11	124	165	454	213	142	21	76
1067	18.34	8.40	15.12	10.5	7.09	4	.44	4.88	6.5	17.88	8.38	5.59	.84	3.00
2067	475	229	387	305	180	102	11	124	165	540	255	163	21	76
2067	18.70	9	15.25	12	7.09	4	.44	4.88	6.5	21.25	10.06	6.44	.84	3.00
2567	475	229	387	305	180	102	11	124	165	540	255	163	21	76
2567	18.70	9	15.25	12	7.09	4	.44	4.88	6.5	21.25	10.06	6.44	.84	3.00

Dimensions for reference only.

INLET
2067/2567 ¾ IN. BSP. (INLET)
1067 ½ IN. BSP.



U.S./IMPERIAL MODELS NEMA 56 FRAME, C FACE



INLET
2067/2567 ¾ IN. NPT
1067 ½ IN. NPT

Important Notice:

Pictorial and dimensional data is subject to change without notice.

Product Specifications

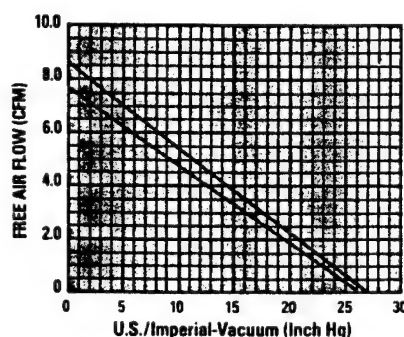
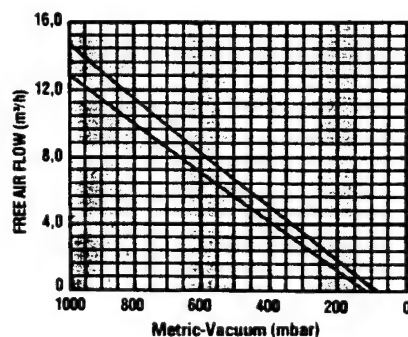
Model Number	Motor	RPM		HP	kW	Net Wt.	
		60 cycle	50 cycle			lbs.	kg
1067-V1	Not included	1725	1425	1/2	0,37	38	17,27
1067-V5-G483X (like 1067-V1 plus motor)	115/230-60-1	1725	—	1/2	0,37	63	28,60
2067-V1	Not included	1725	1425	1	0,75	55	25,00
2067-V3 (metric)	Not included	1725	1425	1	0,75	55	25,00
2067-V5-G468X (like 2067-V1 plus motor)	115/230-60-1	1725	—	1	0,75	84	38,18
2567-V1	Not included	1725	1425	1½	1,10	51	23,18
2567-V3 (metric)	Not included	1725	1425	1½	1,10	51	23,18
2567-V5-G471 (like 2567-V1 plus motor)	230/460-60-3	1725	—	1½	1,10	93	42,00
*2567-V3-CC110-1	220/240-380/415-50-3	—	1410	1½	1,10	93	42,00

*Available only in Europe.

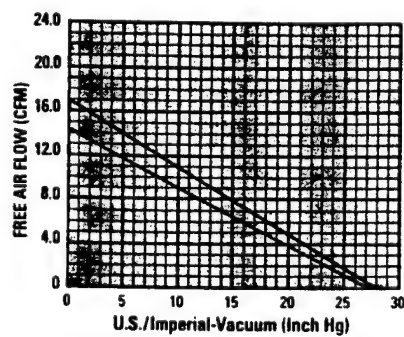
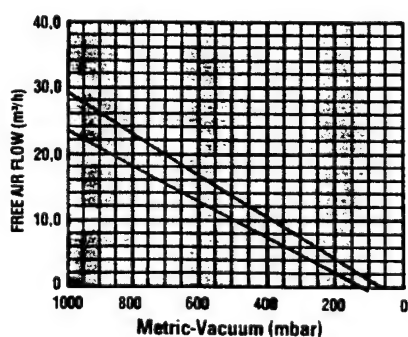
Product Performance (Metric U.S. Imperial)

Black line on curve is for 60 cycle performance.
Blue line on curve is for 50 cycle performance.

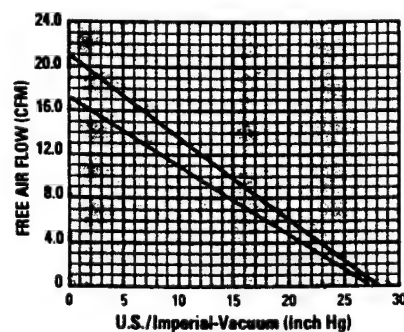
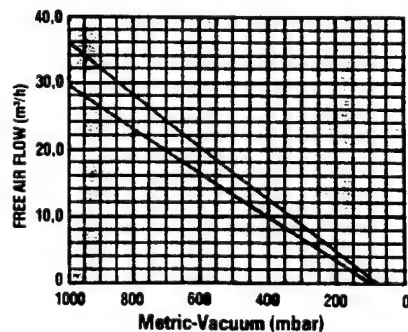
Model 1067

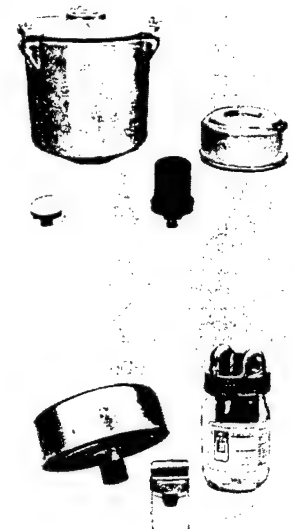

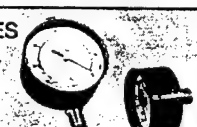
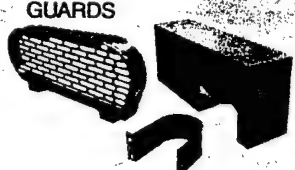




Model 2067



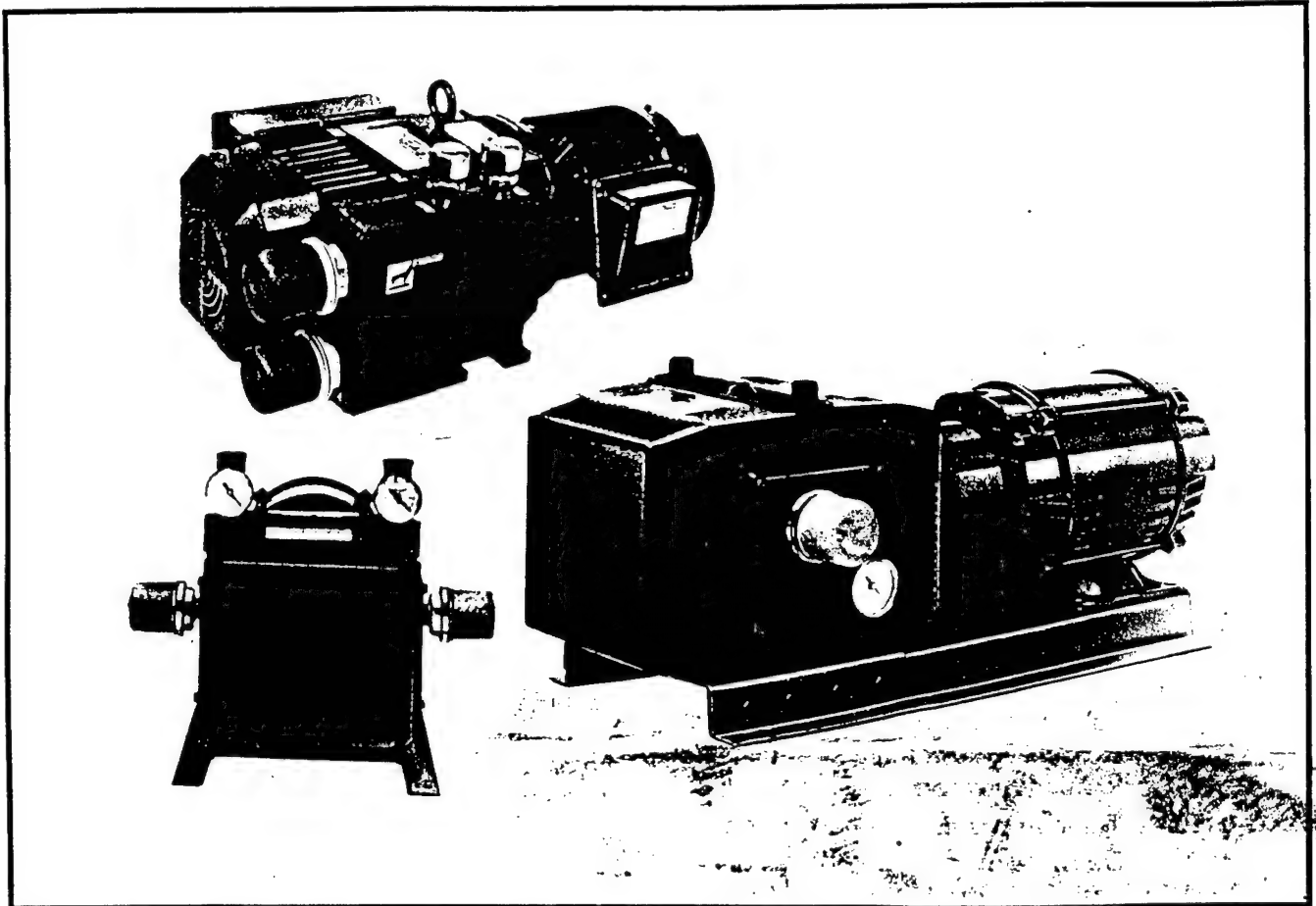
Model 2567



ACCESSORY	PART NO.	DESCRIPTION	USED ON
FILTERS 	AA617G	1/4" NPT, 2 OZ GLASS JAR, 50 MICRON	0211, PISTON LAB UNIT
	AA922H	1/8" NPT, 3/4 OZ GLASS JAR, 50 MICRON	0531-1531, 0533-1533
	AD560	1" NPT, 2 QT GLASS JAR, 50 MICRON	4565, 5565, 6066
	AB599	3/8" NPT, 1 PT GLASS JAR, 10 MICRON	0870, 0823, 1023
	AB600	1/2" NPT, 1 PT GLASS JAR, 50 MICRON	1550, 10 x 1040
	AB600F	1/2" NPT, 1 PT GLASS JAR, 10 MICRON	0765, 1550
	AA800C	1/2" NPT, 1 QT GLASS JAR, 10 MICRON	1065, 1067
	AA900D	3/4" NPT, 1 QT GLASS JAR, 10 MICRON	2065, 2067, 2565, 2567, 3040, 4565
	AA900J	3/4" NPT, 1 QT GLASS JAR, 50 MICRON	11 x 1740
	V400G	1/4" NPT, 8 OZ GLASS JAR, 50 MICRON	0211, 0323, 0523, 1VAF
	V500D	3/8" NPT, 8 OZ GLASS JAR, 50 MICRON	0465, 0765, 0740, 10 x 1040
	AB609D	1/4" NPT, 8 OZ METAL JAR, 10 MICRON	0323, 0523, 0740, 1VAF
	AB612	1/2" NPT, 8 OZ METAL JAR, 10 MICRON	1067, 1550
	AB608B	3/8" NPT, 8 OZ METAL JAR, 10 MICRON	0823, 1023, 1065
	AB650C	3/4" NPT, 1 QT METAL JAR, 10 MICRON	2065, 2565, 3040
	AB665	1/2" NPT, 1 QT METAL JAR, 50 MICRON	10 x 1040
	AA617H	1/4" NPT, 4 OZ PLASTIC JAR, 50 MICRON	NOT USED ON STOCK UNITS
	AA922N	1/8" NPT, 3/4 OZ PLASTIC JAR, 50 MICRON	NOT USED ON STOCK UNITS
	V400H	1/4" NPT, 8 OZ PLASTIC JAR, 50 MICRON	NOT USED ON STOCK UNITS
	V500N	3/8" NPT, 8 OZ PLASTIC JAR, 50 MICRON	NOT USED ON STOCK UNITS
	AV460	1" NPT CATCH POT-STYLE FILTER	R1, R2, 6066 VACUUM SYSTEM
	AV460C	1 1/4" NPT CATCH POT-STYLE FILTER	R3
	AG337	1 1/2" NPT AUTOMOTIVE TYPE FILTER	SDR4, R4, R5
	AJ151G	2 1/2" NPT AUTOMOTIVE TYPE FILTER	SDR5, SDR6, R6, R6P
	AJ151H	3" NPT AUTOMOTIVE TYPE FILTER	SDR6P, R6PP, R6PS, R7
	AG551	1/4" NPT AUTOMOTIVE TYPE FILTER	DIRTY ENVIRONMENT COMPRESSED AIR SYSTEMS
FOOT SUPPORTS 	AC136	METAL STAMPING WITH FEET & FASTENERS	0211, 0323, 0523
	AE241	METAL STAMPING WITH FEET & FASTENERS	4VSF, 4VCF, 5VSF, 5VDF
	AE245	METAL STAMPING WITH FEET & FASTENERS	1VAF, 1VSF, 1VBF
GAUGES 	AE136	1/4" NPT BACKMOUNT, 2" FACE, 0-30" HG	DOA LAB UNITS
	AA640	1/4" NPT BOTTOM MOUNT, 2" FACE, 0-30" HG	ALL VACUUM PUMPS EXCEPT BLOWERS
	AJ497	1/4" NPT BOTTOM MOUNT, 2 5/8" FACE, 0-60" H ₂ O	R1-R4
	AE134	1/4" NPT BOTTOM MOUNT, 2 5/8" FACE, 0-160" H ₂ O	R5-R7, SDR4-SDR6P
GUARDS 	AB334B	V-BELT GUARD	1550
	AC102B	V-BELT GUARD	2565-V220-T41
	AB331A	V-BELT GUARD	3040
	AE777	V-BELT GUARD	4565
	AK372	V-BELT GUARD	SDR4-SDR6
	AE873	COUPLING GUARD	0240-0740, 0465-2565
	AE973	COUPLING GUARD	5565, 6066
HANDLES 	AC174	BENT ANODIZED ALUMINUM	0211, 0323, 0523, ROA
	AF554	REINFORCED ANODIZED ALUMINUM	1VAF, 1VBF, 1VSF
	AF554	REINFORCED ANODIZED ALUMINUM	0823, 1023, 4VCF, 4VSF
	AC268	BENT PLATED STEEL	1531
HOSE & TUBING 	AH325F	16" REINFORCED PLASTIC TUBING (NEEDS AH138E CLAMPS)	0523 VACUUM SYSTEM
	AH325E	17 1/2" REINFORCED PLASTIC TUBING (NEEDS AH138A CLAMPS)	1023 VACUUM SYSTEM
	AH325	16 3/4" REINFORCED PLASTIC TUBING (NEEDS AH138C CLAMPS)	2565 VACUUM SYSTEM
	AH307C	25 1/2" REINFORCED PLASTIC TUBING (NEEDS AH138D CLAMPS)	5565 VACUUM SYSTEM



70 AND 80 SERIES ROTARY VANE VACUUM PUMPS & COMPRESSORS



OPERATION & MAINTENANCE TECHNICAL MANUAL

CONTENTS:

General Information, Installation and
Operation.....2-3

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Ordering Information.....4-5

80 Series Exploded View and Parts
Ordering Information.....6-7

Kit Installation.....8

Relief Valve Recommendations.....9

Troubleshooting & Accessories.....10

Warranty Policy and
Service Facilities.....11

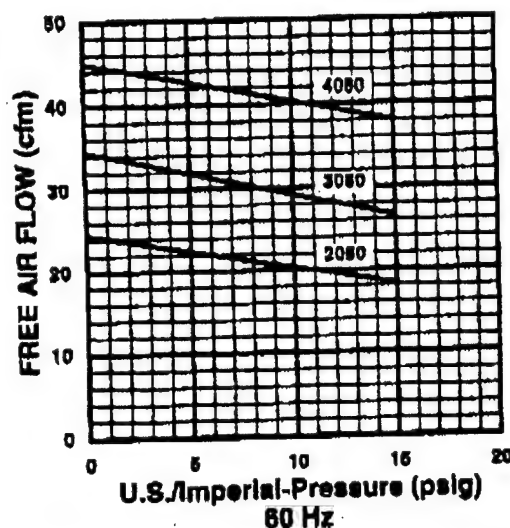
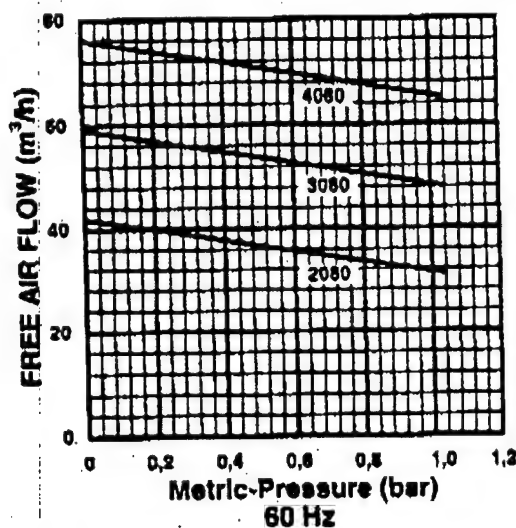
Product Specifications

Model Number	Motor*	RPM		HP	KW	Net Wt.	
		50 Cycle	50 Cycle			Lbs.	kg
2080-P101	Not Included	1725	1425	2	1,5	91	41,3
2080-P121-T337	230/460-60-3	1725	—	2	1,5	130	59
3080-P101	Not Included	1725	1425	3	2,2	92	41,8
3080-P121-T338	230/460-60-3	1725	—	3	2,2	156	70,8
4080-P101	Not Included	1725	1425	5	3,73	93	42,2
4080-P121-T339	230/460-60-3	1725	—	5	3,73	166	75,4

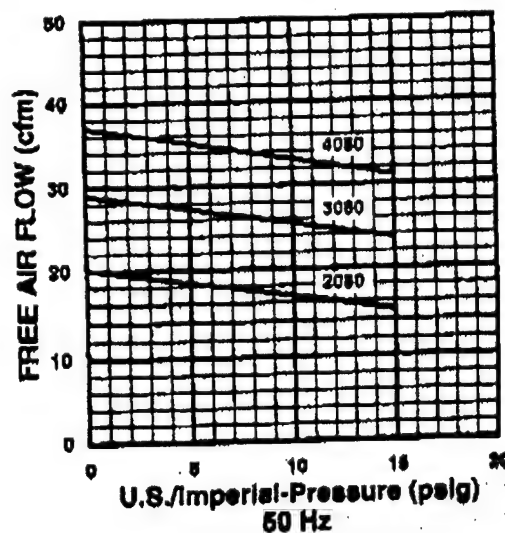
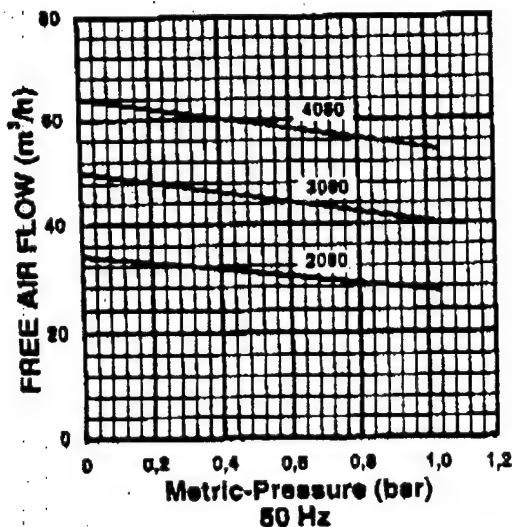
*Gast recommends magnetto starter for electric motor, consult electrician for correct size.

*Product Performance (Metric, U.S. Imperial) Black line on curve is for 50 cycle performance.
Colored line on curve is for 50 cycle performance.

60 Hz



50 Hz



*Performance curves shown are without accessories. The addition of a regulator will decrease the maximum duty and flow. The amount of reduction will vary depending on the application and duty selected.

This is the hazard alert symbol: Δ When you see this symbol, be aware that personal injury or property damage is possible. The hazard is explained in the text following the symbol. Read the information carefully before proceeding.

The following is an explanation of the three different types of hazards:

- Δ **DANGER** Severe personal injury or death will occur if hazard is ignored.
- Δ **WARNING** Severe personal injury or death can occur if hazard is ignored.
- Δ **CAUTION** Minor injury or property damage can occur if hazard is ignored.

GENERAL INFORMATION

- Δ **DANGER** Do not pump flammable or explosive gases or operate the unit in an atmosphere containing them.
- Δ **CAUTION** The exhaust air of this pump can become very hot. Do not direct exhaust air towards property that is temperature sensitive.
- Δ **CAUTION** The pump is designed for air only. Do not allow corrosive gases or particulate material to enter the pump. Water vapor, oil-based contaminants, or other liquids must be filtered out.
- Δ **CAUTION** Ambient temperature should not exceed 40°C (104°F). For operation at high temperatures, consult the factory.

Performance is reduced by lower atmospheric pressure found at high altitudes. Consult a Gast distributor for details.

Never lubricate this oil-less pump. The sealed bearings are grease-packed. The service life of the carbon vanes will be reduced by petroleum or hydrocarbon products.

INSTALLATION

- Δ **CAUTION** Do not lift the unit by the front shroud. The unit should be lifted by means of the eye bolt.
- Δ **WARNING** To avoid risk of electrocution do not use this product in an area where it could come in contact with water or other liquids. If exposed to the elements it must be weather protected.
- Δ **CAUTION** Do not block the flow of cooling air over the pump in any way.

MOUNTING THE PUMP

The pump may be installed in any orientation as long as the flow of cool, ambient air over the pump is not blocked. To reduce noise and vibration, mount to a stable, rigid operating surface.

For units supplied with an adapter plate (see pgs 4 & 5) be careful to securely attach plate to both motor and unit; be sure the casting numbers on plate are positioned at top. Attach adapter plate to motor with (4) socket head cap screws, then attach this to pump with 4 fasteners supplied with adapter plate.

PLUMBING

To prevent air flow restriction, use pipe and fittings that are the same size or larger than the threaded ports of the pump. **NOTE:** The exhaust on vacuum pumps and inlet on pressure pumps is through the small holes in the muffler box cover (2 holes on the 70 Series, 3 on the 80 Series).

ACCESSORIES

Intake and exhaust filters are internal to the pump and will provide adequate filtration for most applications. Check filters periodically and replace when necessary. Consult a Gast representative for filter recommendations. Install relief valves and gauges at the inlet or outlet, or both, to monitor performance.

WIRING

⚠WARNING Incorrect wiring can result in electric shock. Wiring must conform to all required safety codes and be installed by a qualified person. Grounding is required. All power to the motor must be de-energized and disconnected when servicing.

Refer to the motor name plate for wiring diagram. All dual-voltage motors are shipped from the factory wired for high voltage. If the motor fails to start or slows down under load, shut the pump off and unplug it. Check that the supply voltage agrees with the motor name plate. Be sure the 3-phase motor turns in the proper direction of rotation after installation. Turning in the wrong direction will drastically reduce vane life.

OPERATION

⚠WARNING Solid or liquid material exiting the unit can cause eye or skin damage. Keep away from air stream.

⚠WARNING Always disconnect the power before servicing. The motor may be thermally protected and will restart automatically when it cools if the thermal protection switch is tripped.

⚠WARNING Do not operate without both the coupling guard and shroud in place. Failure to do so could result in severe personal injury.

⚠CAUTION Do not operate units above recommended pressures or vacuum duties. To do so will damage the unit.

STARTING

If the pump is extremely cold, let it warm up to room temperature before starting. If the pump does not operate properly, see the troubleshooting guide (pg 10).

PERFORMANCE

Recommended duty ranges are as follows:

Compressors up to 15 PSI.

Vacuum Pumps up to 25-26" Hg. depending on model.

Dual Function Models for 80 Series- 9 PSI, 18"Hg.

Dual Function Models for 70 Series- 5 PSI, 15"Hg.

MAINTENANCE and INSPECTION

Regular inspection can prevent unnecessary damage and repairs. The internal intake and exhaust filters require periodic inspection and replacement. Filters are accessed by removing filter box covers.

⚠WARNING The exhaust muffler and muffler box cover may become very hot during operation. Do not touch these parts until the pump has been turned off and allowed to cool.

Most problems can be prevented by keeping filters clean. Dirty filters decrease pump performance and can decrease pump service life.

FLUSHING

Flushing may be required to remove foreign material that accumulates in the pump and causes the vanes to stick. Several teaspoons of flushing solvent should be introduced into the intake port while the pump is running.

SHUT-DOWN PROCEDURES

Proper shutdown procedures must be followed to prevent pump damage. Failure to do so may result in premature pump failure. The Gast Manufacturing Rotary Vane Non-Lubricated vacuum pumps and compressors are constructed of ferrous metals or aluminum which are subject to rust and corrosion when pumping condensable vapors such as water.

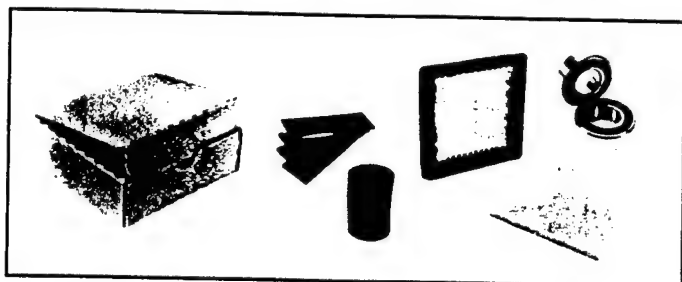
Follow the steps below to assure correct storage and shut-down between use:

1. NEVER oil this non-lubricated pump.
2. After using the pump, disconnect plumbing and allow the pump to run "open" for at least 5 minutes before shut-down. It is now ready for shut-down or storage.

SERVICE KIT INSTALLATION

NOTE: Gast will not guarantee the performance of a field rebuilt pump. You can return the pump to a Gast authorized service facility, or perform the rebuild procedures described below.

Each service kit contains most or all of the following: bearings, vanes, gaskets, and filter elements. Follow these general steps to install the kit:



PUMP DISASSEMBLY:

1. Disconnect the pump from electrical power.
⚠ WARNING You must disconnect the pump from electrical power before servicing it. Failure to do so can result in severe personal injury or death.
2. Vent all air lines to the pump to remove pressure.
⚠ WARNING You must vent all air lines to the pump to remove pressure before servicing it. Failure to do so can result in severe personal injury.
3. Remove the shroud and fan.
4. Use a wheel puller to remove the dead-end plate and bearing from the pump body; note the direction of the bevel edge on the vane. Do not damage the dowel pins between the end plate and the body. Save the bearing spacer on the dead-end of the shaft for reassembly. Remove the snap ring from the end plate. Save the snap ring, belleville springs, and washer for reassembly.
5. Remove the bearing from the dead-end plate.
6. Check the exposed surfaces of the rotor, body, and end plate for scoring. If you find no scoring, you can perform a Minor Rebuild to replace only the vanes and the dead-end bearing.

If you find severe damage, perform the Major Rebuild.

MINOR REBUILD:

7. Install the new vanes supplied with the kit. Be careful to face the vane bevels in the proper direction (as noted in step 4).
8. Place end plate over the shaft with dowel pins aligned. Place bearing spacer on dead end of shaft. Place the new bearing in its bore in the dead end plate. Be careful to press only on the inner bearing race.
9. Install and tighten the pump body bolts. Install the belleville springs with the washer between them, and the snap ring.

MAJOR REBUILD:

7. Remove the drive end cap. Use a wheel puller to remove the drive-end plate and bearing from the pump body. Do not remove or damage the dowel pins in the body. Save the bearing spacer and endplate gasket for reassembly.
8. Place one of the new bearings in its seat in the drive-end plate, then place one of the shoulder rings on the drive-end of the shaft. Using an arbor press, press the bearing onto the shaft. Be careful to press only on the inner bearing race. Tighten the pump body bolts.
9. Install the new vanes supplied with the kit. Be careful to face the vane bevels in the proper direction (as noted in step 4).
10. Perform step #8 from Minor Rebuild.
11. Install the belleville springs with the washer between them, and the snap ring. Install and tighten the pump body bolts.
12. Apply a thread-lock adhesive and start the drive end cap into its thread in the drive end plate, but do not tighten it.
13. Place a dial indicator against the dead-end of the shaft to measure axial movement. Tighten the drive end cap until the indicator show .002" to .0025" of the shaft movement against the belleville springs.
14. Replace the filter elements.

TROUBLESHOOTING GUIDE

REASON FOR PROBLEM	VACUUM LOW	VACUUM HIGH	PRESSURE LOW	PRESSURE HIGH	PUMP OVER-HEATING	MOTOR OVER-LOAD
FILTER DIRTY	X		X		X	X
MUFFLER DIRTY			X		X	X
VACUUM LINE COLLAPSED	X				X	X
RELIEF VALVE SET TOO HIGH		X		X	X	X
RELIEF VALVE SET TOO LOW	X		X			
PLUGGED VAC. OR PRES. LINE	X			X	X	X
VANES STICKING	X		X			
RUNNING AT TO HIGH RPM		X		X	X	X
VANES WORN (REPLACE)	X		X			
SHAFT SEAL WORN (REPLACE)	X		X			
PARTICULATE MATERIAL IN PUMP	X				X	X
MOTOR NOT WIRED CORRECTLY	X		X			X

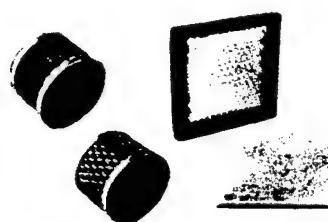
ACCESSORIES/KITS



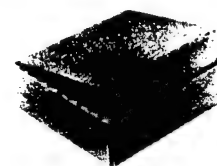
Gauges



Relief Valves



Filter/Muffler Kit



Complete Rebuild Kits

Vacuum Gauge AA640
(1/4" NPT, Bottom Mounted)

Vacuum Gauge AE136
(1/4" NPT, Back Mounted)

Pressure Gauge AA644B
(1/4" NPT, Bottom Mounted)

Pressure Gauge AN190
(1/4" NPT, Back Mounted)

Vacuum Relief Valve AN226
(3/4" NPT, 15-55 cfm)

Vacuum Relief Valve AN226A
(3/4" BSP, 25-93 m3/h)

Pressure Relief Valve AN225
(3/4" NPT, 15-45 cfm)

Pressure Relief Valve AN225A
(3/4" BSP, 25-76 m3/h)

Pressure Relief Valve AN225B
(3/4" NPT 45-75 cfm)

Pressure Relief Valve AN225C
(3/4" BSP, 76-127 m3/h)

70 Series Vacuum Pumps
K561

70 Series Compressors
K563

70 Series Dual-Function Pumps
K565

80 Series Vacuum Pumps
K552

80 Series Compressors
K552

80 Series Dual-Function
Pumps K547

70 Series Vacuum Pumps
K560

70 Series Compressors
K562

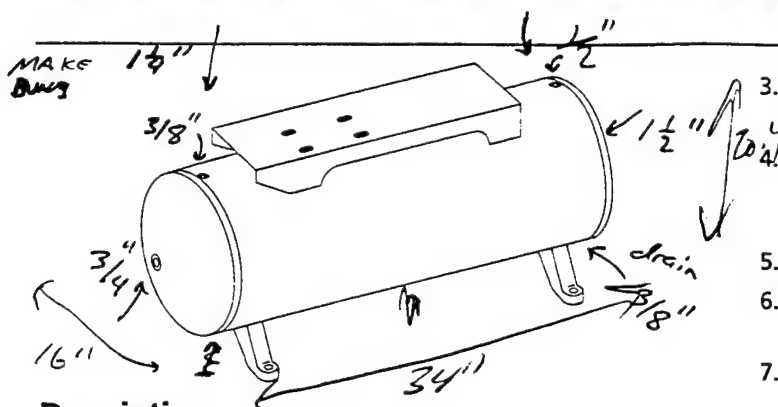
70 Series Dual-Function
Pumps K564

80 Series Vacuum Pumps
K546

80 Series Compressors
K546

80 Series Dual-Function
Pumps K551

Dayton® Stationary ASME Code Air Tanks

**Dayton®**

Dayton® Stationary ASME Code Air Tanks

IMPORTANT: When isolators are used, a flexible coupling should be installed between tank and service piping.

▲ CAUTION *Never use wooden shipping skid(s) as vibration isolators.*

▲ CAUTION *Unsecured tanks can result in electrical hazard and fire due to electrical supply cable becoming disconnected.*

▲ WARNING *Never drill or weld the pressurized part of air tanks.*

- When equipment is installed on the tank, always provide appropriate belt guard and shields to prevent contact with moving or hot parts.
- Do not weld or modify the pressurized part of the tank. It is allowable to drill holes in the base-plate only for the purpose of mounting the pump or guards.

▲ WARNING *No other product alteration or modification is advised.*

REMOVAL OF INSPECTION PLUG

To remove the ASME Inspection Plug from 15 and 30 gallon tanks, use a wrench with a jaw opening of 2 1/8". To remove the ASME Inspection Plug from 60, 80 and 120 gallon tanks, use a wrench with a jaw opening of 2 3/16". Turn counter-clockwise.

INSTALLATION OF ASME INSPECTION PLUG

To install the ASME Inspection Plug on 15 and 30 gallon tanks, use a wrench with a jaw opening of 2 1/8". To install the ASME Inspection Plug on 60, 80 and 120 gallon tanks, use a wrench with a jaw opening of 2 3/16". Be sure the O-Ring on the ASME Inspection Plug is present and in place. Torque (clockwise) the plug from 42 ft. lbs. minimum to 100 ft. lbs. maximum.

▲ WARNING *Failure to comply with these guidelines can result in personal injury and/or property damage due to tank failure.*

Operation

▲ CAUTION

- These tanks are designed and intended to be used as air receivers only.*
- Do not exceed maximum allowable compressor and motor size. See Specifications.*
- Maximum pressure of tank should not exceed 200 psi.*

Maintenance

▲ WARNING *Drain moisture from tank daily. Failure to drain tank can result in weakening due to rust and bursting.*

Cal - OSHA code 462 (L) (2) listings

Tank Model No.	Gallons	Type	Pump Models Approved	Max. Pump RPM
5Z358	15	Horiz.	1Z943	835
			2Z498	930
			2Z499	750
			2Z630	750
			2Z870	1750
5Z359	30	Horiz.	1Z944	745
			1Z945	710
			3Z170	660
			2Z498	930
			2Z499	750
			2Z630	750
			2Z870	1750
			4Z460	1750
			3Z897	820

APPENDIX B

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